



# **Dog-owner interactions during a staged veterinary visit**

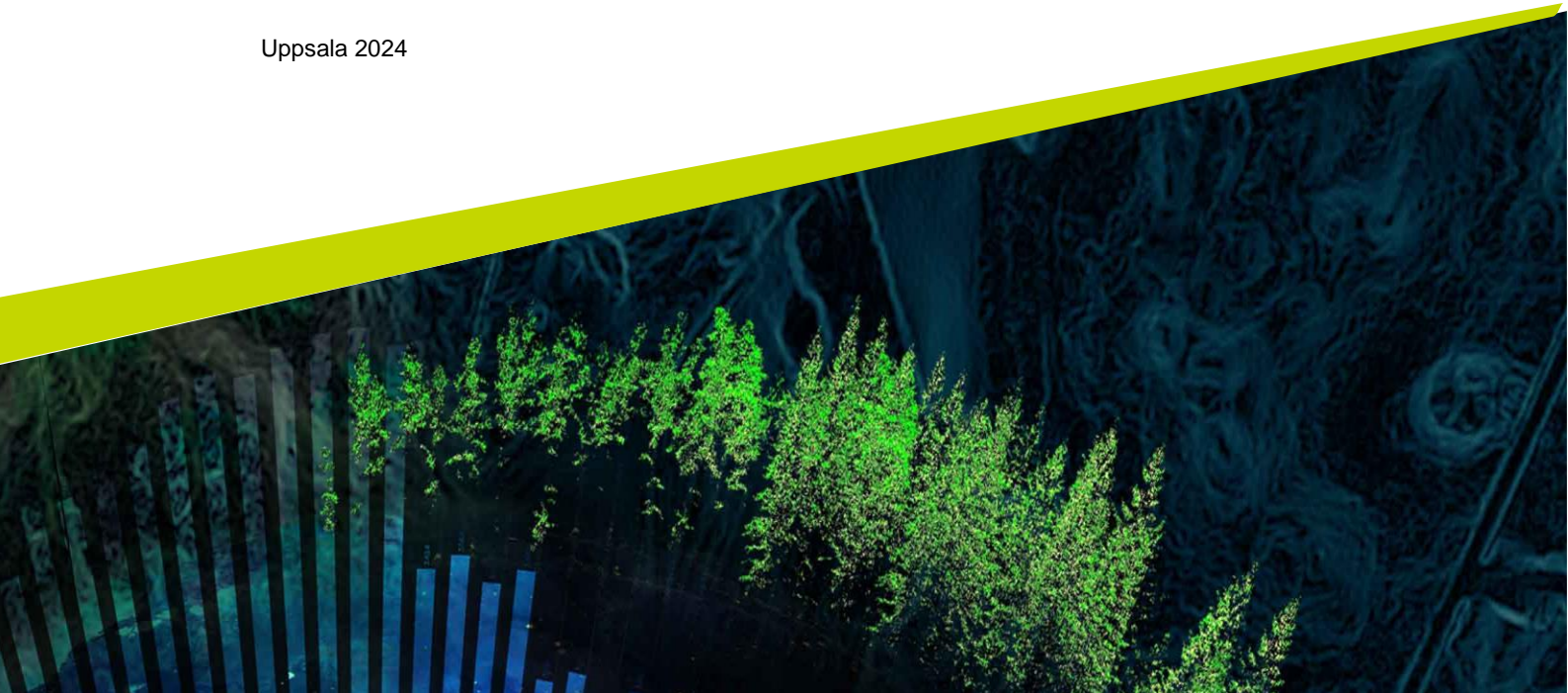
Influence of owners' adult attachment style and  
personality

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Independent Project • 30 credits  
Swedish University of Agricultural Sciences, SLU  
Faculty of Veterinary Medicine and Animal Science  
Veterinary Medicine Programme

Uppsala 2024





# Dog-owner interactions during a staged veterinary consultation - influence of owners' adult attachment style and personality

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**Credits:** 30 credits

**Level:** Second cycle, A2E

**Course title:** Independent Project in Veterinary Medicine

**Course code:** EX1003

**Programme/education:** Veterinary Medicine Programme

**Course coordinating dept.:** Department of Clinical Sciences

**Place of publication:** Uppsala

**Year of publication:** 2024

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**Keywords:** Anthrozoology, veterinary consultation, dog owner interactions, adult attachment style, personality, caregiving

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## Abstract

This study investigated the role of dog owners' adult attachment style and personality on dog-owner interactions during a staged veterinary visit. A total number of 20 healthy, non-aggressive dogs and their owners participated in a standardised, non-invasive, veterinary consultation. Owners' scores in two questionnaires, Attachment Style Questionnaire (ASQ, reflecting adult attachment style) and Big Five Inventory (BFI, reflecting personality), were investigated with regards to correlations with their own and their dogs' behaviour using video recordings. The consultation was divided into four parts, mirroring events in a real veterinary consultation: pre-examination phase (owners were not allowed to interact with their dog), examination phase and post-examination phase which consisted of two parts: one where the owner was available to interact with their dog, and one where they were allowed to interact but given a task that redirected their attention away from the dog.

Owners who scored higher in subscales related to more avoidant adult attachment had dogs who spent less time in their proximity during the pre-examination phase. Moreover, these dogs were more frequently in contact with the door after the examination. These results may be interpreted as these dogs being more independent and less reliant on their owners. This is in line with previous findings in children and dogs of caregivers with a more avoidant attachment style. Owners who scored higher in conscientiousness (BFI) interacted less with their dogs during the examination, which supports previous research indicating that this personality trait affect owners' caregiving behaviour.

This study suggests that owners' adult attachment style and personality may influence the behaviour of the owner and the dog during a staged veterinary visit. This study is limited by a small sample size and the fact that all dogs were healthy. Further research, including e.g. physiological measures, is required to investigate if this can be generalised to a larger population and to a real veterinary setting.

*Keywords:* anthrozoology, veterinary consultation, dog owner interactions, adult attachment style, personality, caregiving

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## Abbreviations

AAS	Adult attachment style
ASQ	Attachment style questionnaire
BFI	Big five inventory
SSP	Strange situation procedure

# 1. Introduction

Many people share their lives with dogs and consider them members of the family, friends or companions for work. This inter-species relationship has evolved during more than 15 000 years, in which dogs have developed a variety of social behaviours and cognitive skills that contribute to the dog-human relationship as we know it (Miklósi & Topál 2013). As companion dogs are under the care and control of humans, referred to as ‘owners’ in this study, the nature of interactions and caregiving behaviour directed towards the dogs may affect the dogs’ welfare.

Adult attachment style influences caregiving behaviour in humans (Mikulincer & Shaver 2007). According to attachment theory, children create an attachment bond to their primary caregiver (Ainsworth 1969). They develop a behavioural strategy to receive social support and security in challenging situations, which vary depending on the response they get from their caregiver (Ainsworth 1969). Research suggest that dogs create similar attachment bonds to humans (Topál et al. 1998), and that a persons’ adult attachment style influences their dogs’ support-seeking behaviour when they are faced with a potential threat (Rehn et al. 2017). Another factor that influences caregiving behaviour in humans is personality traits (Prinzle et al. 2009). Personality has been found to influence how a person interacts with their dog (Kis et al. 2012; Cimarelli et al. 2016), their perception of their dog (Kotrschal et al. 2009; Chopik & Weaver 2019) and their dogs’ behaviour (Kotrschal et al. 2009; Wedl et al. 2010).

Veterinary visits are perceived as stressful for many dogs as well as owners (Volk et al. 2011; Edwards et al. 2019a). Several factors contribute to dogs’ stress levels at the veterinary clinic: the physical environment (Dawson et al. 2016), negative experiences (Döring et al. 2009; Stellato et al. 2021), being handled or restrained (Mariti et al. 2017; Stellato et al. 2019) and/or being separated from their owner (Kim et al. 2010). Researchers have investigated whether dogs’ behaviour is influenced by the presence of their owner during a veterinary visit (Csoltova et al. 2017; Stellato et al. 2020; Girault et al. 2022; Helsly et al. 2022). Generally, their results indicate that dogs were less stressed or had a lower increase in stress measures when the owners were present and used positive interactions.

To our knowledge, no previous research has investigated how the owners’ adult attachment style and personality may influence dog-owner interactions in a veterinary setting. A better understanding of the factors that influence dog-owner

interactions in challenging situations, such as a veterinary consultation, can hopefully contribute to increased welfare for dogs in terms of access to veterinary care, reduced in-clinic stress and enhanced owner-support.

## 1.1 Aims of the study

This study aimed to explore how owners' adult attachment style (AAS) and personality influenced dog-owner interactions during a staged veterinary consultation. Specifically, this study aimed to investigate the following:

- How is the owners' behaviour towards their dogs during the veterinary consultation related to the owners' AAS and personality?
- How is the support-seeking behaviour of dogs during the veterinary consultation related to the owners' AAS and personality?

## 2. Literature Review

### 2.1 Attachment theory

Attachment theory originates from the 1950's and was originally applied to describe the bond between infants and their mothers (Bretherton 1992). Attachment describes a long-lasting affectionate bond from one individual towards another, in contrast to a relationship which is characterised by the involvement of more than one individual, as pointed out by Rehn & Keeling (2016). Individuals bond with their primary caregiver (attachment figure) as they depend on them for survival, signalling their need for safety and support to the attachment figure when they are in distress. This is referred to as the attachment system, a behavioural repertoire that serves to gain proximity to the attachment figure, and is known to be activated in stressful conditions such as separation from the attachment figure (Bowlby 1969). In turn, when the attached individual experiences distress and their attachment system is activated, the corresponding behavioural system in the caregiver is activated, i.e. the caregiving system (Bowlby 1969). According to Bowlby (1958) attached individuals learn by experiences with their attachment figure, to create expectations and adjust their behaviour based on the responses they get. This way, attached individuals develop strategies that are functional (to receive support) in their environment and in interactions with their attachment figure, resulting in different attachment styles.

To investigate attachment styles in toddlers, Ainsworth & Bell (1970) developed the Ainsworth's Strange Situation Procedure (ASSP). The purpose of this procedure is to activate the attachment system by separating the child from the attachment figure and exposing them to a stranger. The behavioural response to separation and reunion with their attachment figure is observed, as well as their tendency to use the attachment figure as a safe haven (seeking proximity for comfort or support) and/or secure base (able to display other behaviours confidently in the presence of the attachment figure, such as exploring). Based on the behaviour of toddlers during the ASSP, Ainsworth (1978) identified three different attachment styles: secure, avoidant and anxious/ambivalent. Later, a fourth attachment style was defined: the disorganised pattern (Main & Solomon 1990). A secure attachment style is characterised by the infants' ability to successfully signal their needs to the attach-

ment figure, and get their needs met consistently. The avoidant and anxious/ambivalent attachment styles are instead described as insecure, and these are developed if the child initially fail to get the support they need from the attachment figure and therefore develop other behavioural strategies. These strategies have been described as altering the attachment system either by hyperactivation (increased signals such as crying, being angry or clingy) or deactivation (decreased signals such as ignoring or distancing from the attachment figure) (Main & Solomon 1990). A child described as disorganised have not developed a clear strategy to gain attention from their attachment figure, and can shift their behaviour between the above mentioned styles, and may express stereotypic behaviour (Main & Solomon 1990).

### 2.1.1 Adult attachment style

The primary attachment bond is believed to form expectations and behaviours in later relationships, via what Bowlby (1969) described as inner working models. These working models are mental representations of others' and self, and are based on experiences and emotions in interactions with attachment figures. These representations are a product of learning, and they are revised and updated through new experiences (Mikulincer & Shaver 2007).

Ainsworth's (1978) attachment styles describe behaviour in infants, whereas other models have been developed to assess attachment in adults using questionnaires or interviews (Mikulincer & Shaver 2007). Adults form new attachment bonds to emotionally significant people such as romantic partners or close friends (Mikulincer & Shaver 2007). Adult attachment style (AAS) can be described using the same three categories used to describe attachment style in infants; secure, avoidant and anxious (see 2.1.2 Caregiving style) (Mikulincer & Shaver 2007). However, AAS is a wider concept that measures an individual's general view of others and self in close relationships, in contrast to the attachment styles in infants. Mikulincer & Shaver (2007) emphasise a dimensional approach to the attachment styles, which allows interpretation of the results on a continuous scale, rather than to categorise individuals.

### 2.1.2 Caregiving style

Bowlby (1969) described the caregiving system as the corresponding system to the attachment system. The purpose is to offer a safe haven to a person in distress and to provide a secure base from which the person feels safe to explore the environment (Bowlby 1969). To provide support to someone else, a caregiver should be sensitive (being able to interpret signals correctly and give an appropriate response) and responsive (being able to provide support in a generous, respectful way and make the other feel validated and understood) (Collins et al. 2006). Consequently,

an adult person's previous experiences of interactions with attachment figures (i.e. their AAS) influences their behaviour as caregivers towards someone else (Mikulincer & Shaver 2007) (Figure 1).

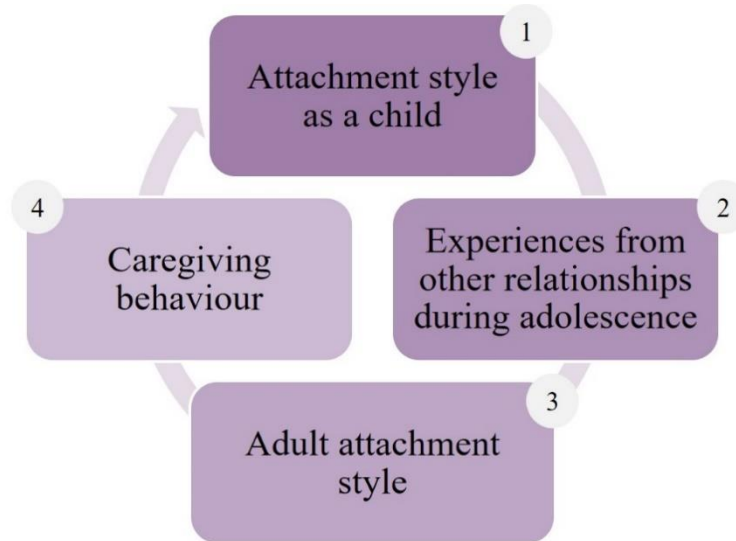


Figure 1. An overview of how a primary attachment style develops into a more general adult attachment style, which in turn affects one's caregiving behaviour and further influencing the development of attachment in offspring/target of care.

Importantly, several other factors, aside from AAS, influence the caregiving behaviour, such as mental health, level/quality of social support and other environmental factors (Mikulincer & Shaver 2007).

*Securely attached* adults are comfortable in close relationships and with being dependant on others or having others depend on them. They trust their partners' availability and support and are rarely worried about being abandoned (Mikulincer & Shaver 2007). As caregivers, their confidence in partners and ability to cope with stressors constructively allows them to be available and attentive towards others' needs. They respond consistently to others' signals, and function as a safe haven as well as a secure base (Collins et al. 2006).

*Avoidant attachment style* describes someone who is uncomfortable with being close to others and finds it difficult to trust or depend on others. They might instead be more self-reliant and distance themselves emotionally (Mikulincer & Shaver 2007). As caregivers, their tendency to deactivate emotional responses can make them less understanding of others' emotional needs and how they wish to be supported. They favour independent behaviour and might be distant or cold in response to needy or emotional signals (Collins et al. 2006).

*Anxious/ambivalent attachment style* is associated with insecurity and fear of abandonment. Therefore, adults who are more anxious in their AAS intensely seek closeness and protection in their partner (Mikulincer & Shaver 2007). Their caregiving strategies may be in conflict with their own need for support, and therefore

the caregiving behaviours are sometimes motivated by their own needs rather than others'. As their own need for closeness and fear of abandonment could interfere with the caregiving system, their attempts at providing support might be perceived as controlling (Collins et al. 2006). Moreover, as they are often preoccupied with their own emotions, they may oversee when others need support, resulting in unpredictable responsiveness (Smith & Pederson 1988).

### 2.1.3 Attachment within dog-owner dyads

The relationship between a dog and their owner is in many ways similar to that between an infant and their parent. Some dog owners consider their role towards their dog to be parent-like, and many report viewing dogs as members of their family which implies social closeness (McConnell et al. 2019). To begin with, the dog-owner relationship is not one of equals (implied by one owning the other one), and the dog depends on their owner to get their needs met. Much like infants, they are in their caregivers' hands. In the daily life of a dog-owner dyad, it is common that the owner makes most decisions about activities and routines. The dog's behaviour is further restricted by social and cultural rules and norms, and they might for example be left alone more than they would prefer. An attachment bond, however, does not require equality or symmetry (Bowlby 1969), as the systems of attachment and caregiving work complementary where one part is motivated to receive care and the other is motivated to provide care.

Based on the ASSP, an attachment test has been developed to investigate attachment bonds in dog-owner dyads, commonly referred to as the Strange Situation Procedure (SSP) in the anthrozoology literature (Topál et al. 1998). Several studies have found that dogs display attachment behaviours similar to infants when subjected to the SSP, supporting the idea that an attachment bond exist between dogs and their owners (Topál et al. 1998; Prato-Previde et al. 2003; Palmer & Custance 2008; Mariti et al. 2013; Rehn et al. 2013). Furthermore, owners' AAS is suggested to influence the behaviour of both dog and owner. Siniscalchi et al. (2013) found that the behavioural response of dogs belonging to 'confident' owners (similar to secure AAS) resembled that of securely attached children in the SSP. A recent study found that more secure owners talked more to their dogs when reunited after a short separation (Ellexelius 2023), possibly reflecting an ability to be sensitive and responsive to their dogs' needs after a challenging situation. In a questionnaire based study by Konok et al. (2015), more avoidant owners had dogs who seemed more vulnerable to develop separation related behavioural problems. The authors suggest that avoidant owners may be less responsive to the dogs' need for support and security in a stressful situation (separation), which can contribute to the development of separation related problems. In a different experimental setup, Rehn et al. (2017) exposed dog-owner dyads to visual, auditory and social stressors as well as a separation-reunion test. The results showed that more secure owners



had dogs who were more oriented towards the stressor and approached the stressor faster, while more anxious owners had dogs who were more oriented towards their owner.

## 2.2 Owner personality

### 2.2.1 The Big Five personality traits

The quality of the dog-owner relationship is influenced by the personality of the owner as well as the dog (Dodman et al. 2018; Chopik & Weaver 2019). In humans, personality is commonly described using the five factor model (John & Srivastava 1999). This model describes personality within five dimensions, described below.

*Extraversion* refers to a person's assertiveness and intensity in social relations. A person scoring high tends to be enthusiastic, energetic and outgoing. A person with a low score tends to be reserved or quiet in social situations. As dog owners, extraverted people tend to rate their dogs as active and excitable (Chopik & Weaver 2019), and they view their dog rather as a companion for shared activities than as social support (Kotrschal et al. 2009). More extraverted owners as well as dog shelter volunteers have been found to praise dogs more (Kis et al. 2012; Shih et al. 2021). Dodman et al. (2018) found that owners with a lower score had dogs who displayed more stranger-directed fear.

*Agreeableness* describes a person's level of sympathy and compassion. People who are warm, considerate, and forgiving tend to get a higher score, whereas people who find it hard to trust others and are more selfish tend to get a lower score. Dog-owners with a higher score in this dimension rated their dogs as less fearful and aggressive in a study by Chopik & Weaver (2019). Shih et al. (2021) found that shelter volunteers with higher scores in agreeableness used more verbal communication with the dogs during a walk.

*Conscientiousness* includes traits related to perseverance and thoroughness. A high score describes someone who is organised, efficient and reliable. A lower score, on the other hand, describes someone who is easily distracted, somewhat disorganised and do not follow through with plans or tasks. High scoring owners rate their dogs as more responsive to training and less fearful and aggressive (Chopik & Weaver 2019). Dodman et al. (2018) found that owners with lower scores had dogs who displayed more stranger-directed fear.

*Neuroticism* refers to emotional instability, suggesting that someone with a high score is more anxious, worries a lot and is easily stressed or upset. A lower score indicates emotional stability, someone who is self-confident, not easily upset and remains calm in tense situations. Dog owners with a high score in this trait consider their dog to be a strong social support (Kotrschal et al. 2009), and these owners tend to rate their dogs as more fearful (Dodman et al. 2018; Chopik & Weaver 2019). In

a study by Wedl et al. (2010), neurotic owners were found to have dogs who spent more time in their proximity during the test.

*Openness* is a measure of creativity and openness to new experiences and ideas. People who score high are curious and inventive, with an appreciation for arts and aesthetics. People with low scores prefer routine work, have narrow interests and have more conventional values. Dog owners with high scores rate their dogs as responsive to training and as less fearful (Chopik & Weaver 2019).

### 2.2.2 Personality and attachment

Personality traits are associated with attachment styles, thereby indirectly with caregiving styles (Nofle & Shaver 2006; Mikulincer & Shaver 2007). A high score in insecure attachment (anxious and avoidant) is associated with a high score in neuroticism, reflecting a negative view of oneself and a tendency to worry (Nofle & Shaver 2006). Moreover, avoidant attachment is associated with low scores in agreeableness and extraversion. This may reflect a tendency to distance oneself emotionally upon distress and respond distantly or coldly as a caregiver (Nofle & Shaver 2006). Both anxious and avoidant attachment style are associated with low scores in conscientiousness, and the secure attachment style is associated with high scores in this dimension (Nofle & Shaver 2006).

The attachment dimensions predict relationship quality (in humans) better than the Big Five dimensions (Nofle & Shaver 2006). Personality, however, still influences behaviour and interactions within the dyad, and is related to how the dog owner perceives the relationship (Chopik & Weaver 2019). Therefore, this study included both adult attachment style and personality as measures of owner characteristics to investigate how they affect dogs' and owners' behaviour in a veterinary setting.

## 2.3 Dog-owner interactions

Through the history of dog-human interaction and the process of domestication, dogs have developed a social and cognitive competence which allows them to form close bonds with humans (Miklósi & Topál 2013). Emotional contagion is a mechanism seen in social species, which allows a group of individuals to synchronise physiologically, behaviourally and emotionally (de Waal 2008). Although typically seen within a species, emotional contagion also occurs in dog-human relationships.

Dogs are able to differentiate between positive and negative facial expressions in unknown humans (Albuquerque et al. 2016). In a novel situation or when encountering an unfamiliar stimuli, it has been shown that dogs look at their owner and adjust their behaviour towards the stimuli according to the owners' behaviour

(Merola et al. 2012b; a). For example, they are more likely to approach a potentially scary object if the owner uses a happy voice and positive facial expressions compared to when they are fearful and worried (Merola et al. 2012a). Therefore, owner behaviour (verbal and physical contact) was observed during the veterinary consultation in the current study.

In addition to facial and vocal signals, dogs use their owners' direction of movement as information when they encounter strangers. Durant et al. (2016) found that dogs synchronise their movement direction with their owner; if the owner moved towards the stranger, so did the dog and *vice versa*. Durant et al. (2017) found that dogs would synchronise their behaviour with the owner when they entered an unfamiliar environment. They observed that dogs would stay in proximity with their owner and gaze in the same direction and that dogs moved and stood still when their owners did. In addition, Durant et al. (2019) found that dogs seem to prefer people who synchronise with them in the same aspects (standing still and walking simultaneously and in the same direction, and gazing in the same direction). However, the tendency to synchronise the behaviour with an owner may be influenced by previous experience and attachment qualities. Hence, the current study aimed to investigate both the effect of AAS on dog behaviour during consultation, but also the potential effects of owner behaviour during the visit.

### 2.3.1 Dog-owner interactions during veterinary visits

Veterinary visits can be experienced as stressful for both dogs and owners, which makes it particularly interesting to observe attachment and personality related behaviours in such a context. As many as 26% of dog owners found it stressful just thinking about taking their dog to the veterinarian (Volk et al. 2011). According to a large study on the database for Canine Behavioural Assessment and Research Questionnaire (C-BARQ), around half of the dogs expressed fear-related behaviour during a veterinary examination (Edwards et al. 2019b). They identified that dogs' fear could be predicted by both dog factors (breed group, age, role, weight, housing) and owner factors (previous experience). Others have reported that previous negative experiences (Döring et al. 2009; Stellato et al. 2021), and the physical environment of the clinic (Dawson et al. 2016) contributed to dogs' stress levels during a veterinary visit. Handling and restraint can affect stress in dogs (Mariti et al. 2017; Stellato et al. 2019), and dogs previously exposed to aversive training methods or forceful handling showed more signs of fear and aggression during an examination (Stellato et al. 2021). Further, dogs may be separated from their owners for procedures or hospitalisation, which can cause separation distress (Kim et al. 2010).

A frequently discussed topic among veterinary staff and pet owners is whether it is best if the owner is allowed in the room for a procedure, or not. Girault et al. (2022) found that dogs were less stressed and more willing to enter the examination

room if their owner was in the room compared to outside. Stellato et al. (2020) found both behavioural differences (less vocalisation, more yawning) and physiological differences (lower mean axillary temperature and, in female dogs, lower HR) between dogs with owner present compared to absent. The results of both studies showed that dogs' behavioural and physiological responses were affected by the presence of their owner during a veterinary visit in a direction that suggest that owner presence is beneficial for dogs.

Csoltova et al. (2017) investigated the effect of dog-owner interactions during a veterinary visit. One group of owners were instructed to use physical and verbal contact during the examination while owners in the other group were instructed to not interact with their dog. They found that dogs made fewer attempts to escape from the examination when owners were allowed to make contact. In addition, dogs' heart rate and maximal ocular surface temperature (OST) increased when owners could not interact with their dogs. This indicates that dogs' stress responses during a veterinary consultation can be alleviated by allowing owners to interact both physically and verbally with their dog (Csoltova et al. 2017). Previous research has established a general preference of physical praise over verbal praise in dogs (Feuerbacher & Wynne 2015) and results from Helsly et al. (2022) showed that only verbal and visual interactions were not enough to alleviate stress during a veterinary visit. Therefore, this study allowed physical and verbal interactions in three phases, while restricting interactions in one.

Physical interactions (Handlin et al. 2011) and mutual gazing (Nagasawa et al. 2015) have been shown to increase the levels of oxytocin in both dogs and their owners, possibly acting as a chemical anti-stress agent. Girault et al. (2022) found that dogs' looked at their owners when they were present in the room during a veterinary consultation, while they were more focused on the door when the owner was absent. It has been found that dogs use gazing behaviour towards humans to seek information when they are in a novel situation (Merola et al. 2012b; a), which is one explanation to the findings by Helsly et al. (2022) and Girault et al. (2022). However, one could also explain it in terms of attachment, where orientation towards the door would be related to proximity seeking to the attachment figure and orientation to owner could indicate directing to a source of safety. Hence, in the current study, gaze orientation was included as one of the measures of dog-owner interaction during a potentially challenging situation.

## 3. Material and Method

This study was based on data collected from questionnaires and behavioural observations. Dogs and owners were recorded during a staged veterinary consultation at the University Animal Hospital at the Swedish University of Agricultural Sciences (SLU) in Uppsala, Sweden. The consultation was divided into four phases, similar to the setup by Helsly et al. (2022) and Girault et al. (2022). First, the owner was asked to focus on the information given and questions asked by the veterinarian while the dog was allowed to move freely in the examination room (pre-examination phase, phase I). Secondly, the veterinarian performed the examination and the owner was allowed to focus on and interact with their dog (examination phase, phase II). After the examination, the dog was allowed to roam free in the examination room again, the owner was allowed to interact with their dog while the veterinarian and the nurse were disengaged, writing notes (post-examination phase, phases III and IV). The post-examination phase was further divided into two parts: part one (phase III) consisted of the moments just after the examination, and in part two (phase IV) the owners were given a task that required them to shift focus from interacting with their dog. In addition, the participants answered two questionnaires related to their adult attachment style and their personality.

Video material were collected in cooperation with another student working on a parallel study investigating stress measures in dogs (Westelius u.å.). For purposes of that study, the dogs' heart rate was measured during the consultation. A third questionnaire about dog-owner relationship (MDORS) were collected but not used in the present study. Data were processed and analysed separately for the respective studies.

### 3.1 Participants

All dogs in this study were privately owned companion dogs. Owners participated on a voluntary basis and were informed about the procedure and their right to withdraw their participation without any explanation or consequence. Owners were anonymised using personal codes only available to the researcher and data was processed so that no result could be connected to a specific person or dog. Agreement was documented using consent forms. This study did not require an ethical approval (7 chap. 2§ and 9§ SFS 2018:1192) as it fulfilled the criteria in the

guidance document by the Swedish Board of Agriculture (7 chap. 17§ and 18§ SJVFS 2019:9, L150). The procedure was non-invasive and posed a low risk of physical or physiological harm to the dogs.

An invitation to participate in the study was distributed online, targeting local dog-related groups on social media, and via posters on notice boards at SLU. Local dog training associations were emailed the invitation and asked to forward it to their members. The invitation contained information about the study as well as a link to an online form. Participants were asked to enter information about themselves and their dogs. The participants were asked about their age and gender. The information collected about the dogs was breed, age, sex, health status and if they had shown aggressive behaviour when handled previously. The duration of the dog-owner relationship was defined by three different intervals (1-5, 6-10 or >10 years). The online form was open for ten days, in which a total number of 43 completed replies were registered.

To participate, the dog had to be healthy (i.e. no known pain or disease), at least one year old and should have been living with the current owner for a minimum of one year. Two dogs with a history of aggressive behaviour towards people, specifically in a veterinary setting, were excluded to reduce the risk of injury to the researchers during handling. To avoid including dogs and owners that were very familiar with the location, staff at the University Animal Hospital were excluded, as well as students in the veterinary programme during the clinical years. Family and friends of the researchers were also excluded.

Dog owners who met the criteria for participation received a personal code via email and were asked to answer three questionnaires online (see details below, section 3.2) prior to the practical procedures. Participants who completed at least two questionnaires and were available on one of the two test days (n=24) were invited to participate in the practical procedures. Originally, a third test date was planned but had to be cancelled due to practical reasons. Therefore, eight people were not invited to participate despite having completed the questionnaires, the only reason being that they were scheduled for the third test day.

In total, 20 dog-owner dyads participated in the practical procedures. All owners were women between 19 and 74 years old ( $40 \pm 17$ , mean  $\pm$  standard deviation), accompanied by dogs ranging from one to eleven years old ( $4 \pm 3.3$ ) of varied breeds (table 1).

## 3.2 Questionnaires

The participants were asked to complete the Attachment Style Questionnaire (ASQ) and Big Five Inventory (BFI) prior to the veterinary consultation, using their designated code. The questionnaires were in Swedish and accessed through the online survey platform Netigate.

Table 1. Participant characteristics regarding breed, sex and age (years) of the dogs, owners' age (years) and duration of relationship (years, reported as intervals of 1-5 years, 6-10 years or >10 years). Since all participating dog owners identified as women, gender was not included in this table. F = female, FN = female neutered, M = male, MN = male neutered

Dog			Owner	Dog and owner
Breed	Sex	Age (years)	Age (years)	Relationship duration (years)
English cocker spaniel	F	1	19	1-5
Galgo español	F	3	44	1-5
Pug	M	4	46	1-5
Crossbreed	FN	2	46	1-5
Lancashire heeler	MN	4	29	1-5
Irish terrier	M	9	42	6-10
Crossbreed	M	2	23	1-5
Crossbreed	MN	3	21	1-5
Border terrier	F	1.5	56	1-5
Labrador retriever	F	2	27	1-5
Terrier brasileiro	MN	11	46	6-10
English springer spaniel	F	8	31	1-5
Chihuahua	F	10	72	>10
Chinese crested dog	M	3	40	1-5
Border terrier	M	1	20	1-5
Welsh corgi cardigan	F	1	20	1-5
Basset bleu de gascogne	F	3	65	1-5
Poodle	F	1	40	1-5
Crossbreed	F	8	36	6-10
Crossbreed	F	7	74	6-10

### 3.2.1 Attachment Style Questionnaire

The ASQ investigates the owners' adult attachment style as manifested in human-to-human relationships (Feeney et al. 1994). In this study, the ASQ was used to indirectly assess caregiving style. The ASQ consists of 40 statements representing five subscales: confidence, discomfort with closeness, need for approval, pre-occupation with relationships and relationships as secondary (briefly described below). Respondents rate to what extent they agree or disagree with each item using a 6-point scale (totally disagree – totally agree).

A high score in *confidence* describes a person who is comfortable in close relationships, find it easy to trust and depend on others as well as having others depend on them (Feeney et al. 1994). High scores in *discomfort with closeness* reflects someone who is uncomfortable in close relationships and struggle to trust and depend on others or having others depend on them (Feeney et al. 1994). Those who score high in *relationships as secondary* view independence and achievement

as more important than relationships (Feeney et al. 1994). Those who get high scores in *need for approval* want others to like them, and may worry that they are not good enough (Feeney et al. 1994). A high score in *preoccupation with relationships* describes someone who tends to worry about their relationships and being abandoned (Feeney et al. 1994).

A more secure AAS is characterised by higher scores in confidence, while the remaining four subscales get lower scores. A more *insecure avoidant* attachment style is defined by higher scores in the two subscales discomfort with closeness and relationships as secondary. Finally, a more *insecure anxious* attachment style is defined by higher scores in the subscales need for approval and preoccupation with relationships. In this study, the participants' score in each subscale contributed to the results, but their individual attachment profiles (i.e. secure, avoidant, anxious, disorganised) were not assessed. The Swedish translation of the ASQ (Håkansson & Tengström 1996) that was used in this study has been validated in a Swedish sample resulting in Cronbach's alphas for the five subscales ranging between 0.62 to 0.78 (Andersson et al. 2002).

### 3.2.2 Big Five Inventory

The BFI is a questionnaire developed to assess personality in humans by investigating five dimensions of personality: extraversion, agreeableness, conscientiousness, neuroticism, and openness (John & Srivastava 1999). The BFI consists of 44 statements, describing personality traits from the reader's perspective (e.g. "I see myself as someone who is inventive."). Respondents rate each statement on a 5-point Likert scale (disagree strongly – agree strongly), resulting in subscale scores for each personality dimension. The questionnaire has been translated to Swedish and tested for reliability and validity in a Swedish context resulting in a Cronbach's alpha ranging from 0.73 to 0.84 (Zakrisson 2010).

## 3.3 Test procedure

### 3.3.1 Test area

The staged veterinary consultations were scheduled on a weekend when the veterinary hospital was closed. All dyads were observed in the same room, which was one of the regular examination rooms used in clinical practice at the veterinary hospital (figure 2). As shown in figure 2, the room included one examination table with an examination lamp above, one chair, two trolleys, one wall mounted shelf and a sink. Not visible for the cameras' views were a cupboard and a computer desk. As this study aimed to simulate a true veterinary visit, not many changes were made in terms of room design. Toys and treats, however, were removed from the



room, and the chair was placed opposite the examination table to facilitate differentiating between attention towards owner vs door (see ethogram, table 3). Throughout the test, the students stood on opposite sides of the examination table, whereas the only instruction to owners was to not cross the floor tape during phase II (figure 2). The examination room and equipment were cleaned and disinfected between participants, and in addition to standard hand hygiene both veterinarian and nurse wore single use gloves.

Two video cameras were used for recording. Camera 1 (iPhone 11) was placed in one corner of the room, recording through a wide-angle lens. Camera 2 (GoPro Hero 9) was attached to the lamp above the examination table, recording from a bird's view using a wide-angle lens. Camera 3 was not used in this study.

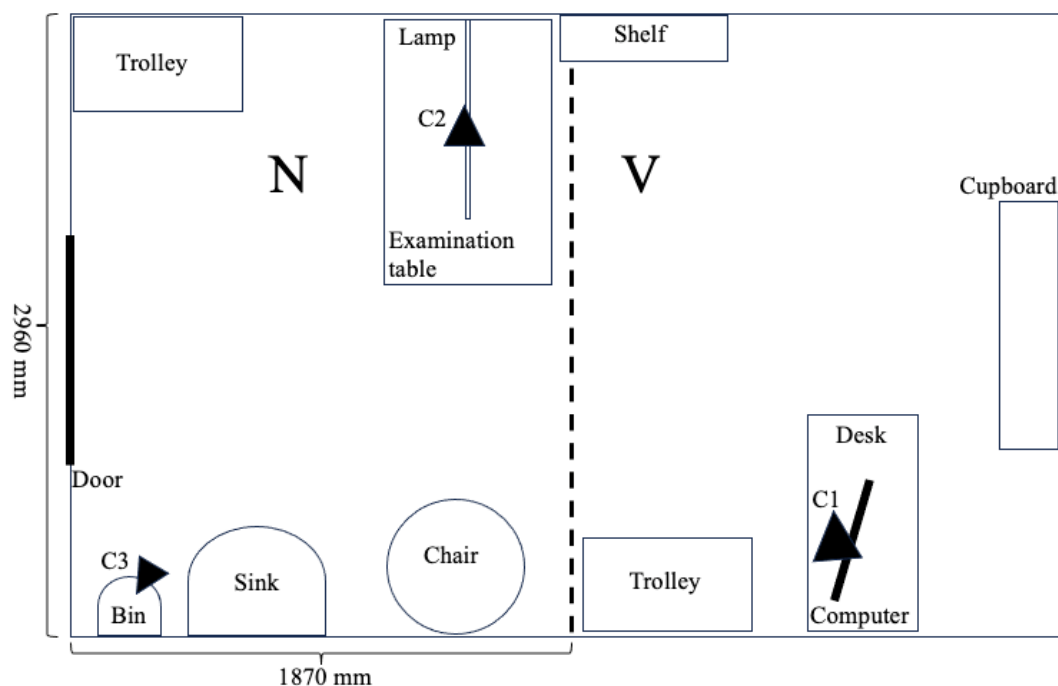


Figure 2. Test room layout. The striped line represents the yellow floor tape owners were instructed not to cross during phase II. N = nurses' position, V = veterinarians' position, C = camera. Cameras one and two were used in this study, both covering the area between the door and the striped line.

### 3.3.2 Behavioural observations

Upon arrival to the veterinary hospital, participants were directed to the waiting room where they got further information about the test. If two dogs were in the waiting room at the same time, they were placed >15 meters apart and separated by visual barriers. Each dog was equipped with a heart rate recording device (Polar V800) approximately 20-30 minutes prior to the test to allow the dog to be habituated to the equipment. Electrode transmission gel was applied on the electrodes, which were placed on the cranioventral aspect of thorax, secured using a pulse

belt. The Bluetooth transmitter was attached to the pulse belt and the Polar watch was attached to the dog's harness or collar, to ensure a close range.

The test consisted of four phases, which all took place within the veterinary examination room, and the total test time was between 4-6 minutes (table 2). Two veterinary students performed as the “veterinarian” and the “nurse” during the tests (same students for all tests). The students did not know or meet the participants (owners or dogs) beforehand. The students were not allowed to initiate or respond to social interactions by the dog (pet/cuddle/talk), and all verbal communication towards the owners followed a manuscript. The timing of phases was done using a smart watch worn by the nurse, which allowed vibrations as the only alarm signal.

*Table 2. Overview of the pre-examination phase (I), examination phase (II) and post-examination phases (first part, III and second part, IV). Dogs were off lead and allowed to roam free in the examination room for all phases except during the examination (II). The veterinarian and the nurse were not allowed to interact physically or verbally with the dog or the owner in any phase, except reading from the manuscript and hold/touch during the examination. Between the phases, the veterinarian read a short text to remind the owners about any rules or restrictions.*

<b>Phase</b>	<b>Duration</b>	<b>Owner</b>	<b>Veterinarian and nurse</b>
I	1 minute	No interactions with the dog*, focus on answering questions and stress assessment	The veterinarian read questions from a manuscript. Completed stress assessment
II	2-4 minutes	Allowed to interact with the dog and to position themselves anywhere between the door and the floor tape (figure 1)	The nurse held the dog while the veterinarian performed the examination
III	30 seconds	Allowed to interact with the dog	Turned towards the wall, writing notes
IV	30 seconds	Allowed to interact with the dog, focus on a task (stress assessment)	Turned towards the wall, writing notes. Completed stress assessment

\* = owners were allowed to respond if their dog initiated contact (phase I)

#### *Phase I: pre-examination*

This phase started as the participants entered the examination room and finished when one minute had passed. Prior to entering, owners were instructed to leave treats and toys outside the room and to let the dog move freely in the examination room (i.e. remove the lead). Owners were instructed to focus on the veterinarian and not to initiate contact with their dog during phase I. However, responding if the dog initiated contact was allowed.

The veterinarian started by presenting themselves and the nurse, reminding the participant about the instructions and asking three questions about the dog (Can you tell me what breed your dog is? What is the color of your dog? How old is your

dog?). The information in the owners' replies during this phase were not included in this study. At the end of this phase, the veterinarian, nurse and owners were asked to assess the current stress level of the dog using a 10-point Likert scale based on the research by Lind et al. (2017).

#### *Phase II: examination*

This phase started when the first phase ended. Owners were asked to guide their dog onto the examination table. If a dog hesitated to voluntarily step up onto the lowered table for 5 seconds without progress, the veterinarian would ask the owner to lift the dog. Owners of very small dogs were asked to lift their dog immediately. The second phase ended when the dog had two or more paws in contact with the floor after the examination.

During phase II, the dogs were standing on the examination table with the nurse and the veterinarian on opposite sides. Minimal physical restraint was used during the examination. The nurse only supported the participating dogs with one hand on the chest and the other hand on the abdomen. The owners were instructed to position themselves anywhere between the door and the yellow floor tape (figure 2) and they were allowed to interact with their dog in a way natural to them during this phase.

The examination followed a standardised protocol and was performed by the same student for all participating dogs. The examination included, in order: heart and lung auscultation, examination of eyes, teeth, gums, ears, palpation of lymph nodes (submandibular, prescapular, popliteal), abdominal palpation, external palpation of anal glands, palpation of all paws (lifted). If a dog was unwilling or resistant to let the veterinarian perform one of the steps, a maximum of three attempts were done before the veterinarian moved on to the next step of the examination. The fear, anxiety and stress spectrum (FAS) (Fear Free 2023) was used to assess the dogs' stress during the examination. The assessments were carried out by the veterinarian, and the procedure would be terminated immediately if a dog displayed signs of severe stress (a FAS-score of 4 or 5).

#### *Phase III: post examination - first part*

This phase started when the dog had at least two paws in contact with the floor and finished when 30 seconds had passed. During phase III, the dogs were allowed to move freely in the room and the owners were allowed to interact with their dogs in a natural manner. The veterinarian and the nurse were writing notes, turned away from the participating dogs and owners, remaining neutral and not initiating or responding to contact.

#### *Phase IV: post examination – second part*

This phase started on the signal that part one of the post examination phase ended, and finished when another 30 seconds had passed. The veterinarian would instruct

the owner to assess their dogs' current stress levels using the same 10-point Likert scale used in phase I. Stress assessments were also performed by the nurse and the veterinarian, using the same scale as the owner. During phase IV, the same rules for dog-owner interactions and behaviour of the veterinarian and the nurse were applied as in phase III. After 30 seconds had passed, the nurse would signal the end of phase IV and stop the recordings.

### 3.4 Data collection

Behavioural observations of the dogs and owners were performed through phase I-IV, using the recorded video material. All observations were performed by the same observer using Mangold Interact (version 18.7.4.12). Based on the predictions, behavioural observations were limited to include dog-owner interactions and attachment behaviours only (table 3 and 4). For dogs, this included gaze direction (attention towards floor was only registered in phase II) and proximity to owner (only registered in phase I, III and IV), sampled instantaneously (5s-intervals). Vocalisation, tail wagging, physical interactions with owner/veterinarian/nurse and exploratory behaviours were registered using one-zero sampling (5s-intervals). Owner behaviour was observed, focusing on dog-directed behaviours such as verbal and physical contact as well as proximity to the dog (the latter was only registered during phase II).

### 3.5 Statistical analyses

Participants got individual scores (mean values) in the respective subscales of the two questionnaires used (ASQ, BFI). Behavioural data were processed in Microsoft Excel (version 16.78.3) and statistical analysis was performed in Minitab (version 19.2020.1.0). Mean proportion of sample points per phase (I-IV) were calculated for each behaviour and participating dyad. Behavioural data and questionnaire scores were analysed pairwise using Spearman rank correlation tests since the data were non-normally distributed. As this was the first time, to our knowledge, that attachment behaviours in dogs were observed in a veterinary setting, an exploratory approach was selected in order to investigate possible effects of the owner characteristics. Hence, all dog behavioural variables were analysed for correlations with each subscale of the ASQ (5 subscales) and BFI (5 subscales), as well as with owner behaviour (5 variables) in the analyses.

A total number of 20 dyads were included in the study, however not all dyads were included in the analysis of every phase. The statistical analyses were performed on 17 dyads that were observed throughout all four phases. Two dyads were partly excluded since they received instructions that differed from the standard

protocol in phase II, III or IV, and one dyad was partly excluded after the examination was terminated due to the dogs' escalating stress. In total, 20 dyads were included in the analyses for phase I, 18 dyads in phase II and 18 dyads in phase III-IV.

Table 3. Dog behaviour ethogram and in which phases the behaviours were included.

<b>Behaviour</b>	<b>Definition</b>	<b>Phase</b>
<i>Instantaneous sampling (5s-interval)</i>		
Proximity to owner	Dog is <arm's length from the owner	I, III, IV
Attention towards: - Owner - Door - Veterinarian/nurse	Dogs' nose points towards the owner, door or veterinarian/nurse. If the door and owner are in the same place, it is interpreted as the dog is attentive to the owner	I-IV
Attention towards floor	Dogs' nose points towards the floor below the table; >50% of the head is located over the edge of the table	II
<i>One-zero sampling (5s-interval)</i>		
Exploring	Motor activity directed towards any physical aspect of the environment; nose close (<2cm) to any object in the environment. If the object is the door, it is registered as both exploring and contact door	I, III, IV
Tail-wagging	Repetitive wagging movement of the tail	I-IV
Vocalising	Dog is barking, growling, howling, or whining	I-IV
Dog in contact with door	Dog is <2cm from the door, if the dog's nose is <2cm from the door, it is registered as both exploring and contact door	I, III, IV
Physical contact with: - Owner - Veterinarian/nurse	Dog leans, jumps up on and/or nudges/licks the owner, veterinarian or nurse, nose is close (<2cm) to the target person	I-IV
Avoidance of: - Owner - Veterinarian/nurse	Dog moves away (increasing distance) or turns head away in response to physical contact initiated by the owner, veterinarian or the nurse	II-IV

Table 4. Owner behaviour ethogram and in which phases the behaviours were included.

<b>Behaviour</b>	<b>Definition</b>	<b>Phase</b>
<i>Instantaneous sampling (5s-interval)</i>		
Owner proximity to dog	Owner is <arm's length from the examination table	II
<i>One-zero sampling (5s-interval)</i>		
Verbal contact	Owner talks/laughs/hum to the dog using a soft, happy or neutral tone (not recorded when speech was directed to the veterinarian or nurse)	II-IV
Negative verbal contact	Owner talks to the dog using a sharp or unfriendly tone, correcting or commanding	II-IV
Physical contact - motion	Owner touches, pets, strokes, or scratches the dog, hands are in motion	II-IV
Physical contact – static	Owner touches the dog and keeps still, hands are not moving (e.g. holding collar/dog)	II-IV

## 4. Results

This exploratory study investigated the influence of owners' adult attachment style and personality on dog-owner interactions during a staged veterinary visit. The results presented below are analyses resulting in correlation coefficients ( $r_s$ ) above 0.5. The results of all correlation tests can be seen in appendix 1.

In general, it was more common for dogs to direct their attention towards the veterinarian or the nurse in phase I, whereas the owner was the most common target of their attention in phase II, III and IV (figure 3). The majority of observations of dogs being in proximity to and initiating contact with their owners were made in phase III, followed by phase IV. It was common for owners to be in proximity to their dog during phase II (figure 4). Owners used more verbal and physical contact in phase II and III than in phase IV.

A few behaviours never occurred (barking, howling, owner negative verbal contact), and others were rarely observed or only observed in certain phases (growling, whining, avoidance of owner). Only variables with a mean value  $>0$  were included in the latter correlation analysis.

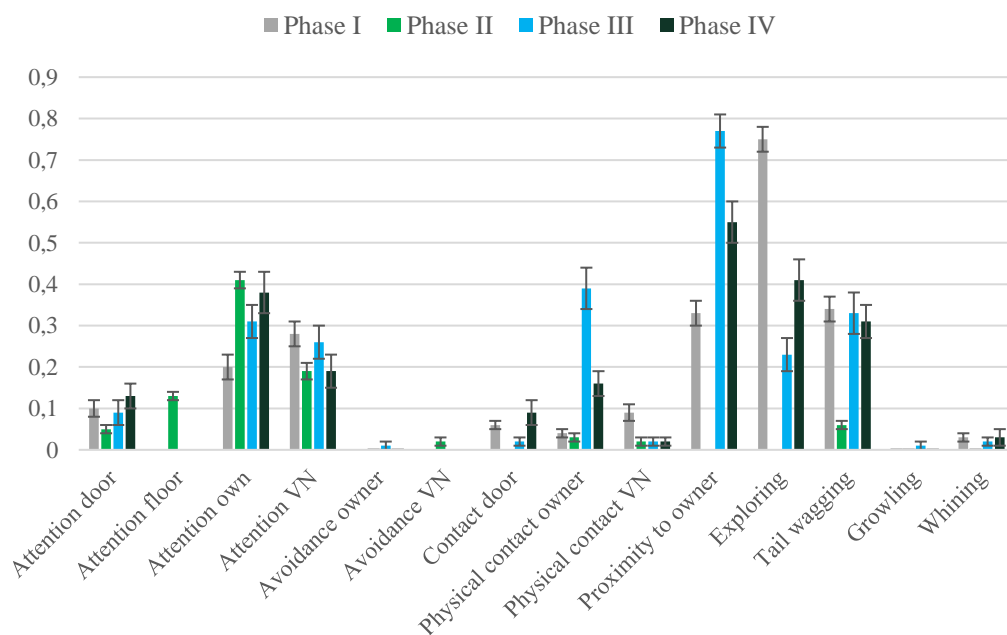


Figure 3. Mean proportion of sample points per phase and dog behaviour (mean  $\pm$  SE),  $n=18-20$ . VN = veterinarian and/or nurse

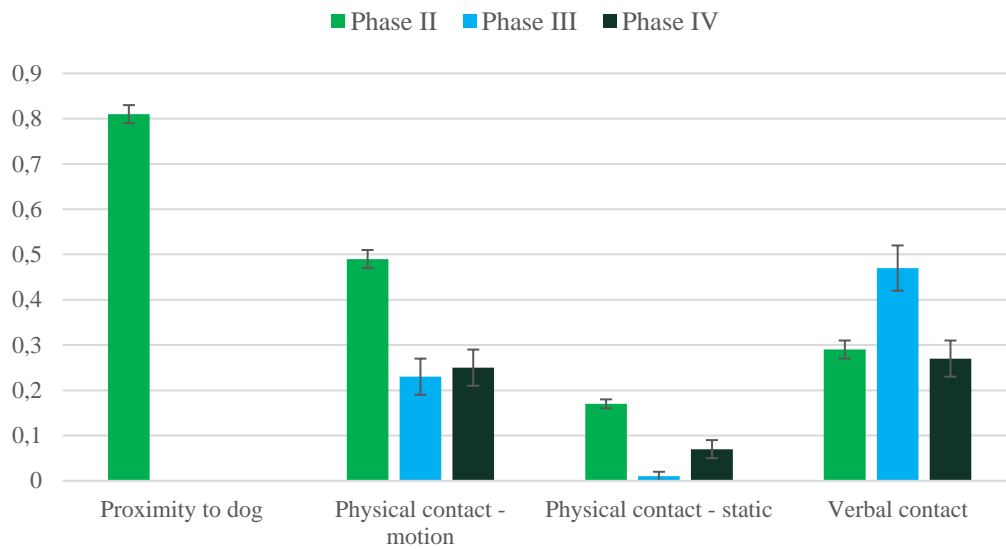


Figure 4. Mean proportion of sample points per phase and owner behaviour (mean  $\pm$  SE),  $n=18-20$ .

## 4.1 Correlations between questionnaires

Owners with higher scores in *extraversion* (BFI) scored higher in *confidence* (ASQ) ( $r_s=0.653$ ), lower in *discomfort with closeness* (ASQ) ( $r_s=-0.602$ ) and lower in *need for approval* (ASQ) ( $r_s=-0.579$ ). Higher scores in *agreeableness* (BFI) were linked to lower scores in *relationship as secondary* (ASQ) ( $r_s=-0.6$ ). Higher scores in *neuroticism* (BFI) were positively correlated with two ASQ subscales: *need for approval* ( $r_s=0.605$ ) and *preoccupation with relationship* ( $r_s=0.532$ ). No correlations were found between *openness* (BFI) or *conscientiousness* (BFI) and the ASQ subscales (Appendix 1, table A1).

## 4.2 Correlations between behavioural observations and questionnaires

### 4.2.1 Owners' adult attachment style (ASQ)

#### *Phase I: pre-examination*

Owners with higher scores in *relationships as secondary* had dogs who spent less time in their proximity ( $r_s=-0.609$ , Figure 5). Owners with higher scores in *need for approval* had dogs who were in contact with the door less often ( $r_s=-0.5$ ).



### Phase II: examination

Owners with higher scores in *preoccupation with relationships* had dogs who directed more attention towards the veterinarian and/or the nurse ( $r_s=0.535$ ).

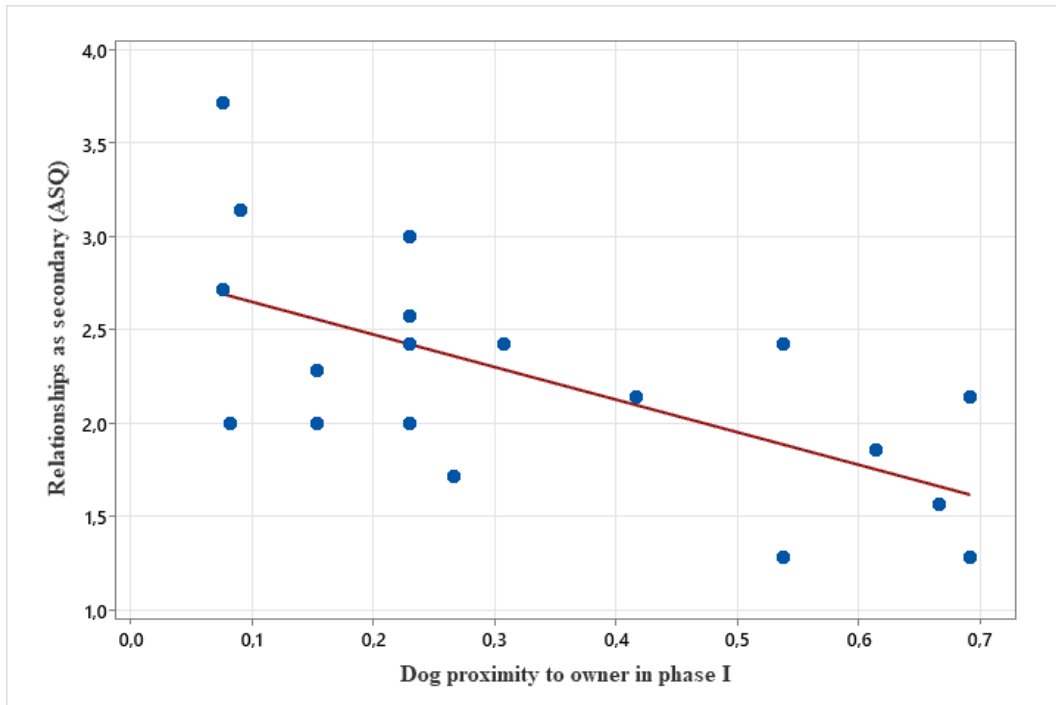


Figure 5. Scatterplot of the correlation between the dog owners' score in relationships as secondary (ASQ) and dog proximity to owner in phase I ( $r_s=-0.609$ ).

### Phase III: post-examination part one

No correlations were found between subscales of the ASQ and dog or owner behaviour in phase III.

### Phase IV: post-examination part two

Owners with higher scores in *discomfort with closeness* had dogs who were in contact with the door more frequently ( $r_s=0.551$ ).

## 4.2.2 Owners' personality (BFI)

### Phase I: pre-examination

Owners with a higher score in *neuroticism* had dogs who directed less attention towards the door ( $r_s=-0.636$ ) and were in contact with the door less frequently ( $r_s=-0.765$ ). Owners with higher scores in *agreeableness* had dogs who spent more time in their proximity ( $r_s=0.542$ , Figure 6). Owners with higher scores in *conscientiousness* had dogs who directed more attention towards them ( $r_s=0.548$ ).

*Phase II: examination*

Owners with higher scores in *conscientiousness* used less physical contact (petting, scratching) ( $r_s=-0.696$ ). Their dogs initiated less physical contact with them during the examination ( $r_s=-0.605$ ). Owners with higher scores in *openness* used more verbal communication ( $r_s=0.502$ ). They were less often in proximity to their dog ( $r_s=-0.605$ ) and used less static physical contact (holding, touching without moving their hands) ( $r_s=-0.513$ ).

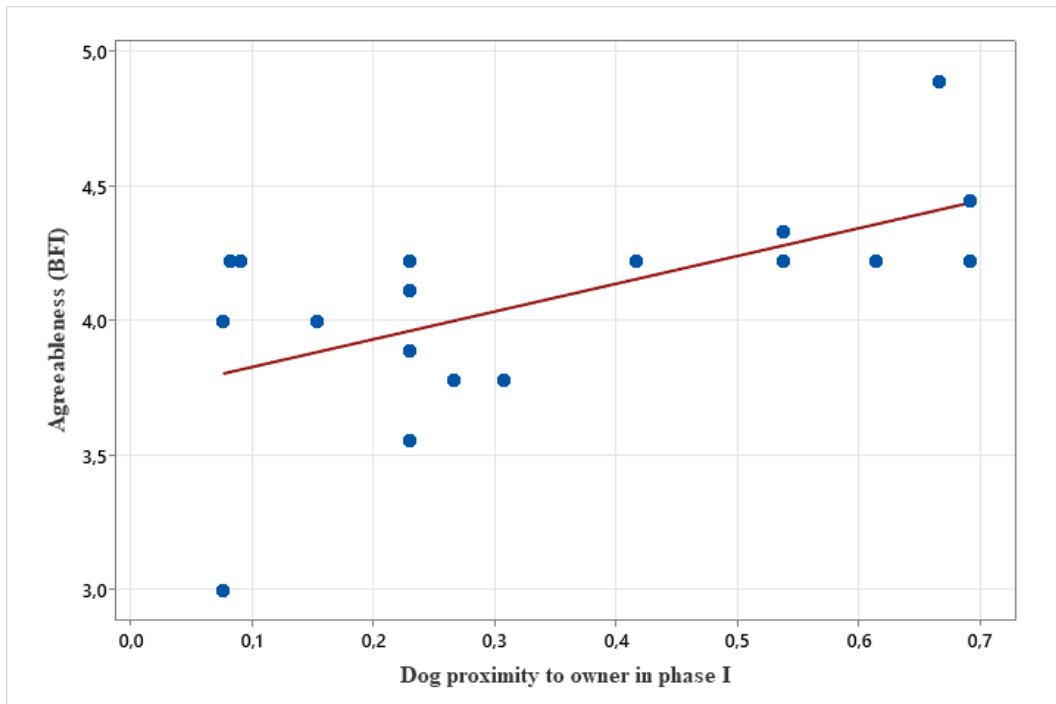


Figure 6. Scatterplot of the correlation between the owners' score in agreeableness (BFI) and dog proximity to owner in phase I ( $r_s=0.542$ ).

*Phase III: post-examination, first part*

Owners with higher scores in *conscientiousness* had dogs who initiated less physical contact with their owner ( $r_s=-0.51$ ). Owners with higher scores in *neuroticism* used more physical contact such as petting or scratching ( $r_s=0.518$ , Figure 7).

*Phase IV: post-examination, second part*

Owners with higher scores in *agreeableness* used more verbal communication ( $r_s=0.56$ , Figure 8).

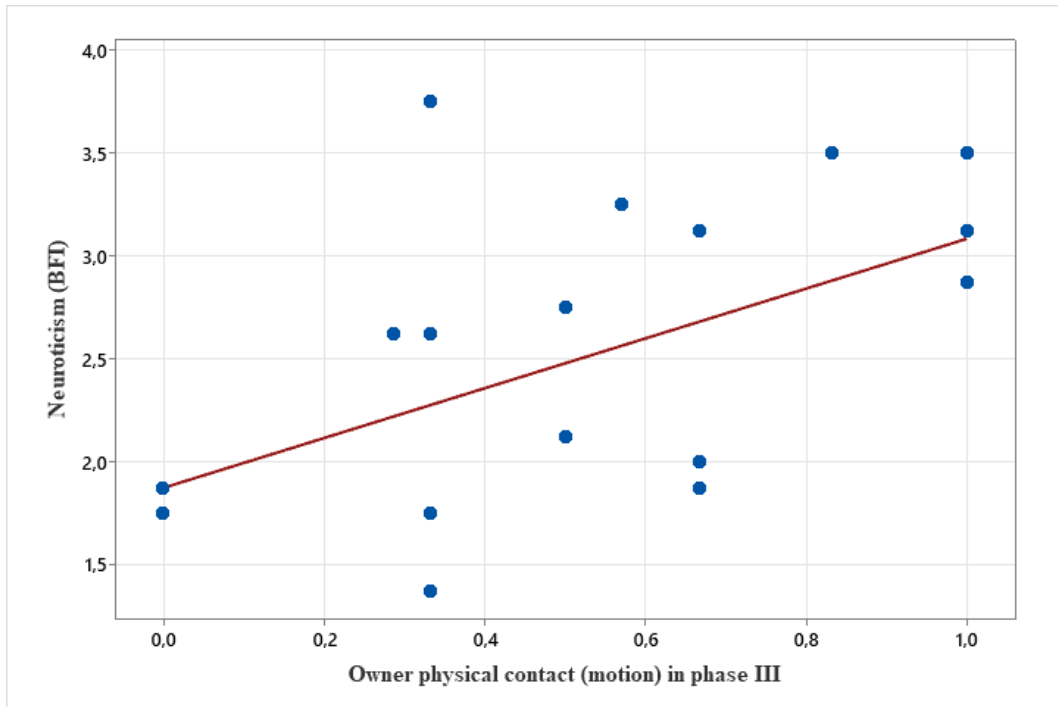


Figure 7. Scatterplot of the correlation between the owners' score in neuroticism (BFI) and owner physical contact with dog in phase III ( $r_s=0.518$ ).

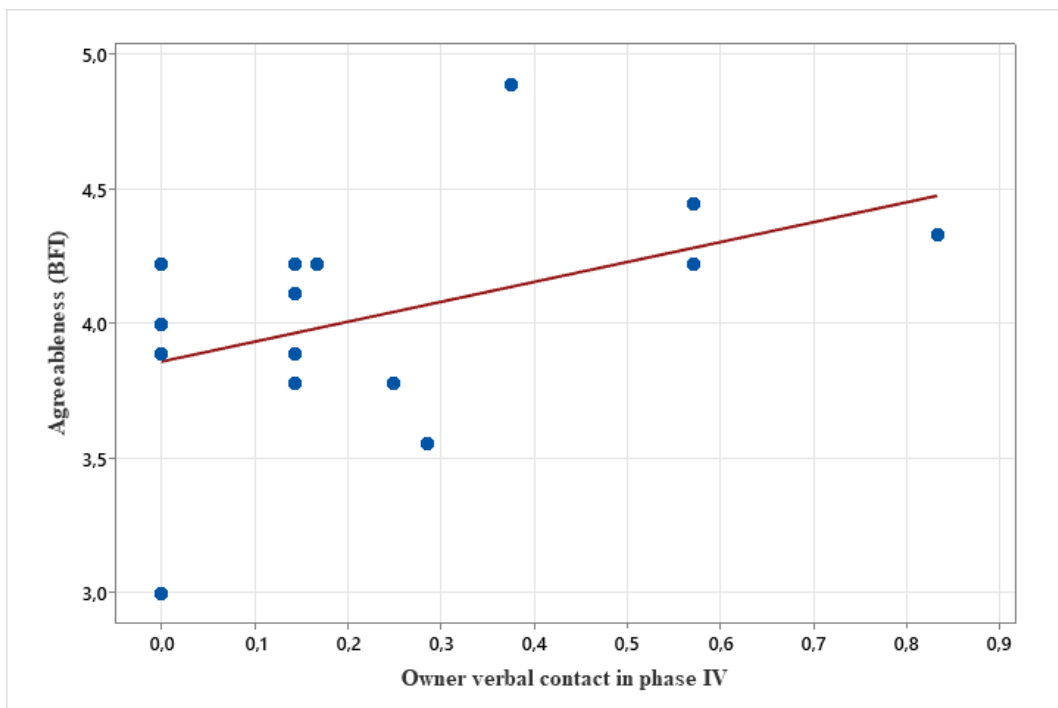


Figure 8. Scatterplot of the correlation between the owners' score in agreeableness and owner verbal contact in phase IV ( $r_s=0.56$ ).

## 5. Discussion

The aims of this study were to investigate the role of owners' behaviour, adult attachment style (AAS) and personality on dog-owner interactions during a staged veterinary visit. Results showed that owner personality traits affected the behaviour of both owners and dogs, while their adult attachment style was linked to dog behaviour only. Importantly, this is a correlation study and the causal relationship of the correlations remain unknown. It is possible, for example, that dog acquisition is affected by owner characteristics.

### 5.1 Effects of adult attachment style on dog-owner interactions

AAS describes a persons' perception of self and others in close relationships. Since the adult attachment profiles are widely referred to in existing literature, the results will be compared to previous findings as *more avoidant* or *more anxious* even if only one of the subsequent subscales was significantly correlated to dog behaviour in the current study.

Caregivers with a more avoidant AAS encourage independence and self-reliance (Mikulincer & Shaver 2007). Assuming that this can be applied on caregiving behaviour towards dogs, these dogs may have been in their owners' proximity less often in phase I because they had learnt to handle unfamiliar situations independently. Results in the current study showed that dogs with more avoidant owners were more frequently in contact with the door in phase IV. This might indicate that these owners did not function as a safe haven, or that these dogs were less affected by the examination and therefore less motivated to seek proximity to their owner. Alternatively, these dogs may have experienced a prolonged negative emotional state after the examination and therefore were more motivated to get out of the room.

More anxious owners had dogs who were less frequently in contact with the door in phase I and directed more attention towards the stressor during phase II. As previously discussed, directing attention towards the stressor could be interpreted as both vigilance or a constructive way of dealing with a potential threat when the needs of security and support from their caregiver are met. This is partly in line

with results in Konok et al. (2019), who found that owners with an anxious AAS had dogs who displayed behaviours indicative of secure attachment with regards to separation related problems. However, they did not use a standardised assessment of AAS. In general, a more anxious caregiver does not encourage independence, and is inconsistent in their response to distress signals (Mikulincer & Shaver 2007). Typically, they fail to provide sufficient social support and security, and rarely function as an effective secure base or safe haven. Without this support, it is likely that the child or dog develop other strategies to gain attention from their caregiver, usually by more clingy and demonstrative behaviour. However, in the current study dogs with more anxious owners did not seek more proximity to their owners during the veterinary consultation.

## 5.2 Effects of owner personality on dog-owner interactions

Personality traits affect caregiving behaviour in parents towards their child (Prinzle et al. 2009) and a growing body of research suggests that this may be true for the interactions and caregiving behaviours of owners towards their dogs (Kotrschal et al. 2009; Kis et al. 2012; Cimarelli et al. 2016, 2017). Although based on a very small sample size, results from the current study indicated that more secure owners had higher scores in extraversion, and that higher scores in the subscales contributing to the anxious AAS was associated with higher scores in neuroticism.

More agreeable owners used more verbal communication in phase III, and their dogs spent more time in their proximity before the examination. A higher score in agreeableness reflects someone who is compassionate and warm (John & Srivastava 1999). These results could reflect the safe haven aspect of attachment (Mikulincer & Shaver 2007). However, there was no correlation found between agreeableness and secure owners in the current study.

Owners with higher scores in openness spent less time in proximity to their dog and used more verbal communication during phase II. Higher scores in openness describes someone who is curious and creative, and in a study by Chopik & Weaver (2019) owners with higher scores in openness reported their dogs as less fearful. If owners with this personality trait in the current study perceived their dogs as less fearful, it may explain why they spent less time in proximity to their dog. This study did not investigate fearful behaviour in dogs, but this would be interesting to look at in future studies, particularly in relation to owners' openness.

Owners scoring high in conscientiousness had dogs that directed more attention towards their owner in phase I. Chopik & Weaver (2019) found that more conscientious owners rated their dogs as more responsive to training, which may reflect owners who value and engage more in training. Mongillo et al. (2016) found that

dogs gazed longer towards their owner, during a non-interactive period in a novel environment, if the dog had a high level of training experience. Therefore, dogs in the current study may have directed more attention towards their owners because they expected training in the situation. During phase II, dogs and more conscientious owners interacted less with each other. This supports results by Cimarelli et al. (2016), who found that conscientiousness was negatively correlated with petting and praising when the dog was in a stressful situation.

Owners with higher scores in neuroticism had dogs who directed less attention towards the door and were less frequently in contact with the door in phase I. These owners used more physical contact such as petting or scratching in phase III. Considering that higher scores in neuroticism is associated with someone who is easily worried, upset or anxious (Prinzle et al. 2009), one could expect a lower ability to act as a social support. However, previous research is somewhat contradictory in terms of the effect of owner neuroticism on dog behaviour.

Chopik & Weaver (2019) found that neurotic owners report their dogs as more fearful. Neurotic owners have been found to be more attentive to their dogs and view their dogs as social supporters (Kotrschal et al. 2009). In a study by Wedl et al. (2010), dogs with neurotic owners spent more time in their proximity, indicating a social attraction towards their owner. Moreover, owner neuroticism has been linked to low morning cortisol values in dogs (Schöberl et al. 2012), low cortisol reactivity during the SSP (Schöberl et al. 2016) and high cortisol variability (Schöberl et al. 2017). Such results might suggest that these dogs experience less stress and/or deal with their stress effectively, possibly by using their owner as a social support in a challenging situation.

There are links between neuroticism and a more anxious AAS (Nofhle & Shaver 2006), which is also seen in the present study. A person with an insecure AAS typically fails to provide a secure base or safe haven. However, previous research has found that neurotic owners (Ellexelius 2023) or owners with an anxious AAS (Konok et al. 2019) have dogs that display behaviours similar to securely attached children. The results of the current study could indicate that these dogs were able to engage in other activities in the room and were less focused on leaving. Moreover, neurotic owners petted their dogs more after the examination, possibly indicating a supportive caregiving behaviour. Hence, it would be interesting to explore how neuroticism influences caregiving behaviour towards dogs, and the possibility that their dogs develop more secure behavioural strategies as a result of their interactions.

### 5.3 Limitations

This study was subject to limitations, which might have influenced the results. Participation in the study was voluntary and recruitment was done using social

media and e-mail. This might have created a selection bias (e.g. higher levels of engagement in dog behaviour and welfare). All participants were women, which was not an inclusion criterion for the study, but gave a more standardised sample. However, this means that results may not be applicable to dog owners of other genders. One inclusion criterion was that the owners must not work at the university animal hospital or be a veterinary student in clinical training, but we did not exclude nurse students, veterinary students in earlier years or veterinarians/nurses from other clinics, nor did we collect information about the participant's occupation. Familiarity with a clinical environment may, therefore, have affected the results of this study.

The voluntary basis of participation might also have affected the sample of dogs. For example, participants may have volunteered to train their young or fearful dog, or because they consider their dog a good fit for a study. Dogs with a bite history were excluded, which limits the possibility to generalise the results to a larger population. The participating dogs were of different breeds and ages, and the size of the sample was small, which affects the reliability of the results. Dogs of different breed groups may display different behaviours, for example use of eye contact, physical contact, vocalising or stranger interactions.

Furthermore, treats and toys were not allowed in the examination room and the owners' interactions with their dogs were restricted in phase I. This allowed for a more standardised setting, but this might have influenced the dogs' and owners' behaviour. Aspects that highlighted that the veterinary consultation was staged may also have affected the participants' behaviour, such as the presence of cameras, not being concerned about their dogs' health, the veterinarian followed a script, and the dogs were not exposed to a noisy, busy waiting room prior to the consultation. This limits the possibility to generalise these results to real veterinary consultations.

All behaviours were observed in 5s-intervals, which could have been shortened to receive more detailed information about the dogs' direction of attention and possibly gaze shifts. Furthermore, proximity to the door could have been defined by marking an area of the floor. This would have been more informative, since physical contact with the door proved to be quite an uncommon behaviour.

Importantly, this was an exploratory study and a large number of correlation tests were conducted. For a more accurate interpretation of the significance of the correlations, the Bonferroni correction could have been used to calculate a p-value that reduced the risk of false significant correlations due to multiple testing. Alternatively, similar behaviours could have been grouped together to reduce the number of tests.

## 5.4 Ethical and societal aspects of the study

This study subjected healthy dogs and owners to a staged veterinary consultation on a voluntary basis. Although the dogs were physically healthy, it is possible that they carry previous negative experiences from the clinic environment or from being handled by strangers. Dogs with previous signs of aggression were excluded beforehand, however, no further information were collected regarding previous experiences with handling or veterinary care. The examination was stopped if a dog displayed signs of severe stress, which occurred during one consultation. Despite our efforts to minimise the risk of causing psychological harm to the dogs, it cannot be completely excluded. In the future, similar studies could observe dogs who had regular appointments at the clinic. On one hand, the strengths of this study's design is that it allows a standardised procedure (same exposure, room, veterinarian and nurse) and lower risk of other factors (i.e. pain, disease, worried owner) contributing to the dogs' or owners' behaviour. On the other hand, the results cannot be directly generalised to the population of dogs visiting a veterinary clinic.

By studying and learning more about dog-owner behaviour and interactions in a veterinary setting, we can more appropriately and effectively apply strategies and resources to minimise dogs' and owners' stress at clinics and optimise treatment of patients.



## 6. Conclusions

This study aimed to investigate influence of owners' adult attachment style and personality on dog-owner interactions during a staged veterinary visit. In this study, dogs belonging to more *avoidant* owners spent less time in their owners' proximity at the beginning of the visit and were more frequently in contact with the door after the examination. This may reflect a dog who is more independent and less reliant on their owner, and supports existing literature on the influence of a more avoidant adult attachment styles on dog-owner interactions. Owners with higher scores in the personality trait *conscientiousness* interacted less with their dogs during the examination, which indicates that this personality trait affected owners' caregiving behaviour, also supporting existing literature.

The influence of *neuroticism* on dog-owner relationships are not yet well understood, and the results among dog-owner dyads differ from what would be expected based on research in humans. The results from this study were no exception, since owner *neuroticism* was linked to dogs displaying less door directed behaviours in the beginning of the visit, which indicates that these dogs were less interested in leaving the room. Moreover, neurotic owners initiated more physical contact (petting, scratching) with their dog immediately after the examination, which might reflect a supportive caregiver. One could expect neurotic owners to be less functional as a social support for their dog. However, these results indicate that these owners attended to their dogs' needs after a challenging situation.

To summarise, this study suggests that owners' adult attachment style and personality may influence the behaviour of the owner and the dog during a staged veterinary visit. This study is limited by the small sample size and the fact that all dogs were healthy. Further research is required to investigate if this can be generalised to a larger population and into a real veterinary setting. The results on how neuroticism influence dog owner interactions is particularly interesting and should be addressed in future research.

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## Popular scientific summary

Many people have a close relationship with their dog and the dog-human relationship could be described as a caregiving relationship, in which the human cares for the dog. As caregivers we are responsible for our dogs' welfare, so it's important to understand how our caregiving behaviour affects our dogs.

Attachment theory is a theory related to caregiving relationships between parents and children. The function of the attachment bond is to ensure the child's sense of security and social support. The child's behaviour towards the caregiver can be categorised into secure or insecure attachment styles. Adults also create attachment bonds to significant people in their lives; this is known as adult attachment style (AAS). Previous research has shown that dogs create similar attachment bonds to their owners. This is significant when we think about dog-owners as caregivers in dog-human relationships. Furthermore, dog-owners' personality also influences how humans interact with their dogs.

An important aspect of caregiving is taking dogs to the vet. Unfortunately, veterinary visits are often stressful for both dogs and owners. The owner's presence can help the dog during visits to the vet, but how are their interactions impacted by the caregiver's attachment style and personality?

In this study, 20 dogs and owners were invited to a staged veterinary consultation. Before the consultation, owners filled in surveys about their attachment style (ASQ) and personality (BFI). The consultation was divided into four phases. In two of the phases the dogs and owners could interact freely without instruction. In one phase the owners were instructed to not interact with their dogs. In the final phase of the consultation the owners were allowed to interact with their dogs, but they were also asked to assess their dogs' stress. The consultations were filmed, and the material was analysed alongside the survey results to see if there are correlations between AAS, personality and interactions between dogs and owners.

The results indicate that owner's adult attachment style and personality influence how dogs and owners interact during a staged veterinary visit. Some results supported existing literature, for example that owners with higher scores in *conscientiousness* (BFI) interacted less with their dogs during the examination phase. An interesting result was related to owners with higher scores in *neuroticism* (BFI). It may be expected that neurotic owners would be less likely to function as social support for their dogs, due to their tendency to worry and susceptibility to



stress. However, the dogs' behaviour before the examination indicated that they were less focused on leaving the room. Moreover, neurotic owners petted their dogs more after the examination, which might reflect a supportive caregiver who attends to their dogs needs after a challenging situation.

This study was limited by a small sample of dogs and owners, and although it was carried out in a veterinary setting, all dogs were healthy which might affect the behaviour of both dogs and owners. Further research is needed to understand how owner characteristics influences dog-owner interactions in a real veterinary setting.

## Acknowledgements

To all the wonderful dog-owner dyads who were a part of this study, thank you!

Thank you to my supervisor, Therese Rehn, for your patience with my many ideas, perseverance and for keeping our meetings light-hearted and fun. Thank you also to my assistant supervisor, Lena Skånberg, for welcoming me into your office and offering support throughout the project. I've really enjoyed working with you both and learnt a lot from our inspiring discussions.

A big thank you to Sofia for volunteering as "nurse". We couldn't have completed the staged consultations without you, and I appreciate that you spent your free time with us in school.

Final thanks to my support crew at home, Smackis, Cléo and Mr. Cat. For cups of tea, being my thesaurus and only stepping on my keyboard sometimes, thanks.

## Appendix 1

In this appendix, results from all Spearman rank correlation tests are presented (table A1-A4). Correlations with a correlations coefficient ( $r_s$ ) larger than 0.5 are indicated by bold figures.

*Table A1. Correlations between dog owners' subscale scores in the big five inventory (BFI) and attachment style questionnaire (ASQ).*

	BFI extraversion	BFI agreeableness	BFI conscientiousness	BFI neuroticism	BFI openness
ASQ confidence	<b>0.653</b>	-0.012	-0.041	-0.321	0.357
ASQ discomfort	<b>-0.602</b>	-0.209	-0.112	0.327	-0.329
ASQ relationships as secondary	0.205	<b>-0.6</b>	-0.386	-0.058	0.179
ASQ need for approval	<b>-0.579</b>	0.07	-0.225	<b>0.605</b>	-0.168
ASQ preoccupation	-0.412	-0.17	-0.087	<b>0.532</b>	-0.1

Table A2. Correlations between owners' subscale scores in the ASQ and dog behaviour in each phase. \*=behaviour was not included in this phase, \*\*=included but never occurred in this phase, exp=exploring, VN=veterinarian/nurse, TW=tail wagging.

		Proximity	Attention towards				Exp	TW	Vocalising		Physical contact			Avoidance	
		Owner	Owner	Door	VN	Floor			Growl	Whine	Owner	VN	Door	Owner	VN
<i>Confidence</i>	I	-0.101	-0.407	0.234	-0.151	*	0.004	0.117	**	-0.178	-0.181	-0.33	0.106	*	*
	II	*	0.181	-0.266	-0.001	-0.159	*	0.154	**	**	0.012	-0.09	*	**	-0.442
	III	-0.157	0.097	-0.2	0.446	*	0.011	0.222	0.219	0.14	-0.04	0	0.025	0.219	*
	IV	0.096	0.002	-0.138	0.063	*	0.042	0.026	**	0.164	-0.216	0.263	-0.184	**	*
<i>Discomfort with closeness</i>	I	-0.242	0.247	-0.235	-0.05	*	0.128	-0.22	**	0.148	0.131	0.1	-0.215	*	*
	II	*	-0.022	0.331	-0.05	-0.106	*	-0.359	**	**	0.164	-0.084	*	**	0.374
	III	0.145	-0.255	0.091	-0.173	*	-0.036	-0.46	0.02	-0.1	0.194	-0.014	0.179	0.02	*
	IV	0.157	0.171	0.454	-0.291	*	0.021	-0.079	**	-0.117	0.165	-0.227	<b>0.551</b>	**	*
<i>Relationships as secondary</i>	I	<b>-0.609</b>	-0.062	0.06	-0.075	*	0.059	-0.126	**	-0.06	-0.287	0.345	0.13	*	*
	II	*	0.095	0.163	0.323	0.193	*	-0.307	**	**	0.071	0.264	*	**	0.176
	III	-0.062	0.011	-0.221	-0.26	*	-0.278	-0.225	0.38	-0.04	0.197	-0.131	0.171	0.38	*
	IV	0.052	0.223	0.21	0.035	*	-0.25	-0.301	**	-0.047	-0.078	-0.044	0.386	**	*
<i>Need for approval</i>	I	0.076	0.04	-0.323	-0.033	*	0.012	-0.059	**	0.366	0.265	0.308	<b>-0.5</b>	*	*
	II	*	0.179	0.231	0.407	0.002	*	-0.064	**	**	0.223	0.296	*	**	0.073
	III	0.111	-0.141	0.16	-0.165	*	0.026	-0.12	-0.299	0.22	0.355	0.087	0.269	-0.299	*
	IV	-0.066	0.333	0.332	-0.366	*	-0.004	0.129	**	0.211	0.001	-0.383	0.164	**	*
<i>Preoccupation with relationships</i>	I	-0.397	0.136	-0.186	-0.228	*	0.203	-0.086	**	0.084	-0.11	0.396	-0.406	*	*
	II	*	0.13	0.235	<b>0.535</b>	0.102	*	-0.255	**	**	0.145	0.386	*	**	0.07
	III	-0.048	-0.034	0.105	-0.183	*	0.008	-0.119	0.02	-0.06	0.217	0.101	0.322	0.02	*
	IV	-0.124	0.232	0.343	-0.175	*	0.027	0.013	**	-0.023	0.155	-0.292	0.367	**	*

Table A3. Correlations between owners' subscale scores in the BFI and dog behaviour in each phase. \*=behaviour was not included in this phase, \*\*=included but never occurred in this phase, exp=exploring, VN=veterinarian/nurse, TW=tail wagging.

		Proximity	Attention towards				Exp	TW	Vocalising		Physical contact			Avoidance	
		Owner	Owner	Door	VN	Floor			Growl	Whine	Owner	VN	Door	Owner	VN
<i>Extraversion</i>	I	-0.088	0.085	0.278	-0.135	*	-0.339	0.149	**	-0.324	-0.3	-0.126	0.456	*	*
	II	*	-0.063	-0.295	-0.206	0.105	*	-0.034	**	**	-0.289	-0.2	*	**	-0.28
	III	-0.108	0.13	-0.045	0.077	*	-0.222	0.279	0.319	-0.14	-0.269	-0.087	-0.023	0.319	*
	IV	0.128	0.052	0.047	0.071	*	-0.415	-0.042	**	-0.164	0.023	-0.162	-0.289	**	*
<i>Agreeableness</i>	I	<b>0.542</b>	0.201	0.143	-0.492	*	-0.042	0.14	**	0.384	0.338	-0.281	-0.079	*	*
	II	*	-0.19	-0.03	-0.316	0.191	*	0.33	**	**	0.157	-0.131	*	**	-0.155
	III	0.092	0.185	0.357	-0.11	*	-0.132	0.411	-0.102	0.143	0.133	0.074	-0.197	-0.102	*
	IV	0.256	-0.045	-0.191	-0.033	*	-0.239	0.406	**	0.143	0.224	-0.204	-0.471	**	*
<i>Conscientiousness</i>	I	0.207	<b>0.548</b>	0.14	-0.264	*	-0.165	-0.085	**	-0.215	-0.174	-0.443	0.101	*	*
	II	*	0.018	-0.123	-0.308	-0.377	*	-0.32	**	**	<b>-0.65</b>	-0.456	*	**	-0.246
	III	-0.381	0.178	-0.147	0.209	*	0.074	0.227	0.12	-0.141	<b>-0.51</b>	0.16	-0.077	0.12	*
	IV	-0.318	-0.012	-0.074	-0.009	*	-0.032	0.232	**	-0.165	-0.349	-0.113	-0.301	**	*
<i>Neuroticism</i>	I	-0.103	-0.058	<b>-0.636</b>	0.078	*	0.392	0.149	**	0.064	0.353	0.171	<b>-0.765</b>	*	*
	II	*	0.322	0.452	0.196	0.006	*	0.1	**	**	0.038	0.217	*	**	-0.302
	III	0.277	-0.146	-0.161	0.023	*	0.232	0.129	-0.08	-0.08	0.368	0.319	0.137	-0.08	*
	IV	-0.057	0.296	0.303	-0.214	*	<b>0.49</b>	0.354	**	-0.047	0.014	-0.398	0.375	**	*
<i>Openness</i>	I	-0.204	-0.079	-0.115	0.097	*	-0.332	-0.018	**	-0.42	-0.173	0.227	0.34	*	*
	II	*	0.275	-0.317	0.168	0.155	*	0.114	**	**	-0.28	-0.102	*	**	0.134
	III	-0.039	0.013	-0.043	0.154	*	-0.214	-0.219	-0.2	-0.12	0.034	-0.116	0.17	-0.2	*
	IV	0.052	0.066	0.009	0.054	*	-0.176	-0.23	**	-0.094	0.087	0.011	-0.302	**	*

Table A4. Correlations between owner behaviour and subscale scores in the ASQ and BFI. Owner behaviour were not registered in phase I as they received instructions on how to act towards their dog, and phase I is therefore not included in this table.

		Attachment style questionnaire (ASQ)					Big five inventory (BFI)				
		Confidence	Discomfort with closeness	Relationships as secondary	Need for approval	Preoccupation with relationships	Extraversion	Agreeableness	Conscientiousness	Neuroticism	Openness
<b>Proximity to dog</b>	II	-0.022	0.35	0.367	0.06	0.254	-0.103	-0.156	0.011	-0.071	<b>-0.605</b>
<b>Verbal contact</b>	II	0.416	-0.453	0.088	-0.186	-0.35	0.41	0.151	-0.491	-0.369	<b>0.502</b>
	III	0.113	-0.017	-0.065	-0.17	-0.052	0.111	0.049	0.085	-0.13	0.264
	IV	-0.029	-0.304	0.353	-0.138	-0.314	0.283	<b>0.56</b>	0.246	-0.252	0.034
<b>Physical contact (motion)</b>	II	0.115	-0.076	0.22	0.295	0.045	-0.122	-0.104	<b>-0.696</b>	0.247	0.155
	III	-0.299	0.132	-0.168	0.161	-0.026	-0.291	0.008	-0.321	<b>0.518</b>	0.017
	IV	-0.103	0.083	0.178	-0.187	-0.21	0.362	-0.012	-0.176	-0.159	0.078
<b>Physical contact (static)</b>	II	-0.178	0.444	0.107	0.246	0.328	-0.272	-0.103	0.308	0.015	<b>-0.513</b>
	III	0.219	0.02	0.38	-0.299	0.02	0.319	-0.102	0.12	-0.08	-0.2
	IV	-0.25	0.432	0.137	0.141	0.094	-0.177	0.137	-0.286	0.145	-0.313

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